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### Publication Date

2017-10-01

### DOI

10.1016/j.asmart.2017.10.001

Peer reviewed



## Social psychological aspects of ACL injury prevention and rehabilitation: An integrated model for behavioral adherence



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### ARTICLE INFO

#### Article history:

Received 2 October 2017

Accepted 2 October 2017

Available online 12 October 2017

#### Keywords:

Treatment motivation

Social cognitive factors

Sport injury prevention and rehabilitation

Behavioral compliance

Theoretical integration

### ABSTRACT

Managing rehabilitation for ACL injury is dependent on uptake of, and compliance with, medical and safety recommendations. In this paper, we propose a multi-theory model that integrates self-determination theory and the theory of planned behavior to identify the motivational determinants ACL injury prevention and management behaviors and the processes involved.

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Anterior cruciate ligament (ACL) tears or ruptures are a frequently reported sport injury<sup>1–3</sup> that may lead to many maladaptive impacts on individuals' health (e.g., impaired functional ability, reduced psychological well-being, heightened risk of re-injury) and sport life or career (e.g., career disruption, suspension, or termination in sport or other occupation, fear of re-injury).<sup>4,5</sup> The main reason for maladaptive post-injury outcomes can be due to insufficient recovery caused by low compliance with treatment and rehabilitation plans prescribed by medical professionals. Typically, treatment involves home-based rehabilitation exercises that are required to be undertaken regularly for an extended period of time (e.g., 6 months), and after recovery individuals are supposed to carefully manage their old injuries to prevent recurrence.<sup>6</sup> In addition, incidence of ACL injuries is high due to poor adherence to preventive measures (e.g., due to low awareness of, or susceptibility to, risk, an underestimation of the severity of the injury, and a lack of knowledge of preventive measures).<sup>1,7,8</sup> Regardless of whether or not ACL injuries have occurred, it is important that individual follows recommended rehabilitation procedures, and acquires

training or education to enhance their knowledge of managing sport injury, otherwise the effectiveness of the safety measures or injury management could be heavily impaired.<sup>9</sup> Nevertheless, compliance with prevention and rehabilitation of sport injury requires effort and commitment on the part of athletes,<sup>10</sup> and reports have revealed poor adherence to measures aimed at rehabilitation and prevention of sport-related injury.<sup>11–13</sup> It is, therefore, important to investigate why individuals do, or do not, adhere to the injury prevention measures, and the psychological and behavioral factors behind the prevention and rehabilitation of sport injury.<sup>9,14</sup> In this paper, we introduce a social psychology model that has shed light into the understanding of the motivation and social cognitive processes that relate to sport injury management.<sup>10,15</sup> The model has potential to provide a comprehensive explanation of the determinants of prevention and rehabilitation of ACL injuries and inform practice. This paper we present the key concepts, and empirical evidence in support, of the model in the context of sport injury management, and discuss how future research could utilize the model to understand the psychological factors evolving individuals' prevention and rehabilitation from ACL injuries and develop optimally effective interventions.

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## Integration of two social psychological theories

The social psychological model of motivation presented in this paper integrates self-determination theory SDT<sup>16</sup>; and the theory of planned behavior TPB.<sup>17,18</sup> The integrated model incorporates the propositions of SDT and TPB, and comprehensively outlines the specific motivational process that relate to health behaviors. It has been extensively applied in many health-related contexts such as physical activity, dieting, condom use, prevention of binge drinking, and injury management.<sup>15,19,20</sup> The development of the integrated model is in line with the recent trend in social and health psychology to adopt an integrated approach that involves multiple theories to explain human behaviors.<sup>21</sup> This trend has been recently applied to the understanding of sport injury prevention and management,<sup>15</sup> with a growing body of research applying this approach.<sup>14</sup> The central rationale for a multi-theory approach is that research applying individual theories has often resulted in a substantive amount of variance in behavior unexplained,<sup>21</sup> particularly when past behavior has been taken into account.<sup>22,23</sup> The advantage of the multi-theory approach is that it leverages strengths from concepts and processes from multiple theories to address limitations and gaps in individual theories and improve the predictive power of the model.<sup>21</sup> Despite the advantages, researchers who adopt multi-theory approach should be mindful about the underlying assumptions of the theories involved, carefully resolve any potential conflicts or redundancies, and derive the temporal or causal mechanism of the variables based on research evidence.<sup>24</sup> As such, the integrated model may combine the strengths and resolve the weaknesses of the theories, leading to a more comprehensive explanation of human behavior.<sup>19,21,24</sup>

The theoretical integrated model presented in this paper was designed to combine the strengths and resolve the limitations of SDT and TPB.<sup>19</sup> The basis of such theoretical integration begins with the premises of SDT in which autonomous motivation is differentiated from controlled motivation.<sup>16</sup> According to SDT, autonomous motivation is the inherent drive toward engagement of particular behaviors. Individuals experience autonomy when they perform behaviors (e.g., preventing sport injuries) for intrinsic (e.g., acting for self-endorsed reasons and out of a sense of choice and personal volition), integrated (e.g., acting to attain fully internalized reasons), or identified (e.g., acting to attain a personally valued goal or outcome) reasons. On the other hand, individuals feel controlled when they perform behaviors for introjected (e.g., acting to avoid externally-referenced contingencies such as guilt and shame) and external (e.g., acting to obtain external incentives or avoid punishment) reasons. In comparison to controlled motivation, autonomous motivation is more efficient in promoting behavioral compliance and long-term commitment because autonomously motivated behaviors are self-reinforcing and independent of external contingencies,<sup>25</sup> and often require less self-regulatory effort (i.e., ego energy) to maintain.<sup>26,27</sup> Promoting autonomous motivation, according to SDT, is essential to facilitate individuals' behavioral adherence and well-being in a given context. Autonomous motivation can be supported by facilitating satisfaction of the three psychological needs: *autonomy* (the need to feel actions as choiceful and self-endorsed), *competence* (the need to feel effective in one's environment), and *relatedness* (the need to feel accepted, connected, and cared for by others).<sup>28</sup> When significant others (e.g., orthopaedic surgeons, physiotherapists) support the psychological needs of individuals who need to manage ACL injury, they are more likely to experience their actions as autonomous rather than controlled and may be more likely to comply with behavioral strategies.<sup>29</sup> The process by which psychological need support enhances autonomous motivation and behavioral patterns (e.g., adherence, intention) of sport injury prevention<sup>10,30–32</sup> and

rehabilitation<sup>33–37</sup> have been supported by empirical research adopting SDT. The strengths of SDT are that it delineates the adaptive motivational process, and offers explanations to how the psychosocial environments could facilitate such process, which are informative to the development of practical strategies for behavior change.<sup>15,19</sup> However, a limitation of SDT is that does not account for the proximal decision-making process of human action, such as individuals' beliefs, planning, and commitment. While Deci and Ryan<sup>16</sup> intimated in their original development of the theory that self-determined motives would lead individuals to align their cognition and beliefs with their motives, the process was explicitly specified.<sup>15,24</sup>

To address this issue, the integrated model incorporates concepts from the TPB,<sup>17,18</sup> including the three social cognitive variables of attitude (positive or negative affective or instrumental evaluation of the behavior), subjective norms (perceived social acceptability or appropriateness of the behavior) and perceived behavioral control (PBC; perceived ease or difficulty of controlling the behavior), and intention (willingness and effort one plans to exert for the behavior), that serve as mediators of the relationship between motivation from SDT and behavior. The integrated model follows the central premise of TPB in which intention is regarded as the most proximal predictor of a volitional behavior in the future, and is a function of individuals' attitudes, subjective norms, and perceived behavioral control (PBC) with respect to performing the behavior in future.<sup>17,18</sup> Furthermore, it is proposed in TPB that the effects of these three factors on behaviors are mediated by intention, with an additional direct pathway of PBC to behavior. The predictions of the TPB have been supported in many studies applying the model to sport injury prevention<sup>38–41</sup> and rehabilitation.<sup>42,43</sup> Despite the strength of TPB in explaining the proximal social cognitive process, TPB does not explicitly identify the potential antecedents of attitudes, subjective norms, and PBC, and does not outline how they may be modified or changed. The integrated model of SDT and TPB combines the strengths of these two theories to resolve their respective limitations and arrive at a comprehensive explanation of behavior.<sup>15,24</sup>

## Research evidence for the model

The integrated model has received growing support from empirical research in different health contexts such as physical activity, dieting, disease prevention, condom use, prevention of binge drinking, and doping in sport and injury management.<sup>15,20,44–49</sup> There has also been research supporting the application of the model in different cultural and national groups.<sup>50–53</sup> In addition, meta-analyses have supported the pattern of effects among the proposed motivational and social cognitive constructs the model across studies.<sup>19,54</sup> The model has recently been applied into the context of injury prevention and rehabilitation in sport and occupational contexts. It was consistently found that individuals with injuries, including athletes, sport participants, and police officers, who reported higher autonomous motivation in preventing injury or during rehabilitation from injury, were more likely to endorse more favorable attitudes, subjective norms, PBC, and intentions toward the injury management behavior, and were also more likely to engage in behavior.<sup>10,30,33,34</sup> Moreover, the perception of psychological need support provided by significant others of these individuals, such as coaches, supervisors, and physiotherapists or other medical professionals, was shown to have direct or indirect effects on these psychological variables and behavioral adherence, consistent with model hypotheses.<sup>10,30,33,34</sup> The research may provide information on the psychological factors that may have the utility in identifying targets for intervention for the prevention or rehabilitation from ACL injuries.<sup>15,33</sup> However,

it should also be noted that the majority of existing studies are correlational in design, limiting the causal inferences that can be made among effects in the model.

### Potential application of the model

The integrated model of SDT and TPB could potentially be applied to predict athletes' personal management of ACL injury prevention and rehabilitation, and to inform future interventions on injury management.<sup>15,34</sup> Based on the model, we speculate that individuals with low autonomous motivation toward prevention and rehabilitation behaviors for ACL injury, will be unlikely to form positive attitudes, subjective norm, and PBC with respect to those behaviors, will be less likely to intend to do them, and will likely exhibit poor behavioral adherence. Existing questionnaires developed to measure variables of the integrated model in sport injury management contexts could be used to track or screen of individuals who are might have problems with motivation to be fully committed to injury prevention and rehabilitation behaviors.<sup>10,30,33,34</sup> Future interventions could target individuals (e.g., athletes, sport participants, ACL ruptured patients) with low motivation and intentions to enhance their motivation, beliefs, intention, and behaviors with respect to the management of ACL injuries.

According to the tenets of the integrated model, interventions may involve strategies that target variables from SDT and TPB. With respect to SDT, the promotion of autonomous motivation could be achieved through strategies that satisfy basic psychological needs in the sport injury context.<sup>28,29,31</sup> For the management of ACL injuries, autonomy could be supported by providing meaningful rationales behind prevention of ACL injuries and the importance of adhering to the safety guidelines to reduce the injury risk. Competence could be supported by highlighting the available coping resources and fostering confidence to manage ACL injuries. Support for relatedness could be delivered by establishing safety culture in which individuals feel that the prevention for ACL injuries is generally accepted or supported, and they feel responsible for their own safety and that of others. Significant others (e.g., physiotherapists, coaches) should avoid using controlling styles, such as punishment for mistakes, personal criticisms, or coercion, to force individuals to comply with safety guidelines or medical regimen for ACL injury management. A controlling interpersonal style has been shown to thwart psychological needs and discourage autonomous motivation.<sup>55,56</sup> Additional strategies alongside need support that target change in the social cognitive variables from the TPB could also be effective in promoting better injury management according to the integrated model.<sup>15,19</sup> Strategies that target enhancing attitudes (e.g., highlighting the pros and diminishing/resolving the cons of managing ACL injuries), subjective norms (e.g., appointing role models, organizing peer-support groups), and PBC (e.g., improving the accessibility and ease of preventive measures and rehabilitation protocols) would be expected to promote stronger intentions to participate in injury management behaviors. Finally, to help individuals establish intention and commitment towards advisory behavior for managing ACL injuries, sport medicine team may assist athletes in implementing a concrete action plan by specifying when, where, and how the prevention or rehabilitation of ACL injuries will be employed.<sup>57–60</sup> According to the integrated model of SDT and TPB, these evidence-based strategies for promoting autonomous motivation, and social cognitive variables, are expected to have positive direct and indirect impacts on intention and behavioral adherence. Interventions that target change in the psychological variables of the integrated model have been successful in promoting change in other health behavior domains.<sup>49,57–59,61</sup> These strategies warrant future studies that

examine the causal and temporal effect of integrated model of SDT and TPB into ACL injury management context.<sup>23</sup> In addition, the advancement of mobile health and smartphone technology, researchers have begun to develop smartphone applications that promote adaptive sport injury prevention behaviors.<sup>62</sup> The integrated model might provide an evidence-base to guide the delivery of the ACL injury management messages and information via smartphone applications, but its effectiveness should be empirically tested in randomized controlled trials.<sup>63</sup> Once this smartphone application is shown to be useful, it might potentially be one of the most cost-effective strategies to promote individuals' adherence towards ACL injury prevention and rehabilitation.

### Conclusion

Identifying the salient psychological factors that relate to individuals' compliance with prevention and rehabilitation for ACL injuries will provide important knowledge of manipulable factors that could be targeted in injury management interventions. In this paper, we outlined the potential of an integrated social psychological model that includes hypotheses and constructs from self-determination theory and the theory of planned behavior to understand the motivational and social cognitive process underpinning behavior that enhance ACL injury management. Research has provided supporting evidence about the hierarchical relationship of the motivational and social cognitive factors of the model, and how the model could be applied into the explanation of intention and behaviors of injury prevention and rehabilitation. A number of behavioral intervention strategies derived from the tenets of integrated model have been identified, and future studies should test their applicability and effectiveness in facilitating the management ACL injury.

### Conflicts of interest

The authors have no conflicts relevant to this article.

### Acknowledgements

The project is supported by Hong Kong Heath and Medical Research Fund [14151301] and the Seed Funding for Basic Research of University of Hong Kong [104003893.092935.45500.301.01] awarded to the first author. Correspondence concerning this article should be addressed to Derwin K. C. Chan, School of Public Health, The University of Hong Kong.

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